CLAIMS

What is claimed is:

1. A communications module configured to selectively couple to a communications panel and a patch panel, the module comprising:

a module casing having an interior portion;

an optical circulator disposed within said interior portion, said optical circulator having a first port through which optical data is transmitted, a second port through which optical data is received, and a third port through which optical data is both transmitted and received;

a duplex connector supported by said module casing and adapted to couple to the communications panel, said duplex connector comprising a first connector supported by said module casing and being adapted to optically communicate with said first port and a second connector supported by said module casing and being adapted to optically communicate with said second port; and

means for optically communicating said third port with the patch panel to enable bi-directional communication of optical data, said means for optically communicating being supported by said module casing.

2. The communications module as recited in claim 1, wherein said means for optically communicating comprises a receptacle adapted to receive a pigtail lead.

3. The communications module as recited in claim 1, wherein said means for optically communicating comprises a pigtail lead integrally formed with the communications module.

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4. The communications module as recited in claim 1, wherein said first connector and said second connector are small form factor pluggable.

5. The communications module as recited in claim 1, wherein each of said first connector and said second connector is a gigabit interface converter.

6. The communications module as recited claim 1, wherein said circulator comprises an optically non-reciprocal core comprising:

a first optical wedge optically coupled to said first port and said second port;

a Faraday rotator optically coupled to said first wedge, said Faraday rotator rotating a polarization of a transmit signal and a receive signal passing therethrough; and

a second optical wedge optically coupled to said Faraday rotator and to said third port.

7. The communications module as recited in claim 1, wherein said first port is adapted to accept optical signals transmitted with a well maintained state of polarization.

8. The communications module as recited in claim 1, wherein said third port is adapted to receive optical signals transmitted with any state of polarization.

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9. A plug-in communication module configured to selectively couple to a communication panel and a patch panel, the module comprising:

a duplex connector supported by a module casing and adapted to couple to the communication panel, said duplex connector comprising:

a first connector supported by said module casing and adapted to receive a transmit signal from the communication panel; and

a second connector supported by said module casing and adapted to transmit a receive signal to the communication panel;

a patch panel connector connected to said module casing, said patch panel connector carrying both optical signals transmitted from the communication panel and optical signals to be received by the communication panel; and

an optical circulator in optical communication with said duplex connector and said patch panel connector, said optical circulator comprising, a first port through which optical data is only transmitted, a second port through which optical data is only received, and a third port through which optical data is both transmitted and received,

wherein said optical circulator directs said transmit signal received at said first port to said third port and directs said receive signal received at said third port to said second port to enable bi-directional communication along a single optical fiber optically coupled to said third port of said circulator.

10. The communications module as recited in claim 9, wherein said first connector and said second connector are a small form factor pluggable connector.

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11. The communications module as recited in claim 9, wherein said first connector and said second connector are a gigabit interface converter.

12. The communications module as recited in claim 9, wherein said patch panel connector is either fixably or removably connected to said module casing.

13. The communications module as recited in claim 9, wherein said circulator comprises an optically non-reciprocal core.

14. The communications module as recited in claim 13, wherein said optically non-reciprocal core further comprises:

a first optical birefringent wedge optically coupled to said first and second ports;

a Faraday rotator optically coupled to said first birefringent wedge, said Faraday rotator rotating a polarization of said transmit signal and said receive signal passing therethrough; and

a second optical birefringent wedge optically coupled to said Faraday rotator and to said third port;

wherein said transmit signal is propagated from said first port in a receive direction, through said second birefringent wedge, said Faraday rotator, and said first birefringent wedge into said third port and said receive signal is propagated from said third port in a transmit direction, through said first birefringent wedge, said Faraday rotator, and said second birefringent wedge and is refracted into said second port.

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15. The communications module as recited in claim, 14 wherein said first port is configured to accept optical signals transmitted with a well maintained state of polarization.

16. The communications module as recited in claim, 14 wherein said third port is adapted to receive optical signals transmitted with any state of polarization.

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17. A communications module configured to selectively couple to a communications panel, the module comprising:

a module casing;

a circulator disposed in said module casing;

a first connector disposed on said module casing and coupled to a first port of the circulator, wherein said first port of said circulator is adapted to transmit optical data;

a second connector disposed on said module casing and coupled to a second port of said circulator, wherein said second port of said circulator is adapted to receive optical data, and wherein said first and second connectors are adapted to couple to the communications panel; and

a third connector coupled to a third port of said circulator, wherein said third port of said circulator is adapted to propagate bi-directional optical data through said third connector.

18. The communications module as recited in claim 17, wherein said first and second connectors are small form factor pluggable connectors.

19. The communications module as recited in claim 17, wherein said first and second connectors are gigabit interface converters.

20. The communications module as recited in claim 17, wherein said third connector is an integrally formed patch panel connector.

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21. The communications module as recited in claim 20, wherein said patch panel connector further comprises an optical fiber attached to said module casing.

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